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HOW TO MAKE A TRACING

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How to Make a Tracing

By J. K. FINCH, C. E.

"What's missed in the tracing won't come out in the blue print."—Eng. News.

The art of making in a minimum of time a clear, neat tracing from which blue prints may be made is a very necessary accomplishment for a young engineer. A large number of engineering graduates make their start in their profession in a drafting room, where their ability is judged and their promotion depends, to a large extent, on the neatness and accuracy of their drafting work. Very often the chief engineer knows his assistants only by the work they turn in to him, and drawings executed in a neat and systematic manner always "look more accurate" and command more attention than careless, "sloppy" work. The ability to do drafting well is worth dollars and cents to every engineering student and, although it can be acquired very easily, it is one of the things that many of our University graduates lack.

Many books have been written on Mechanical Drawing, but they are expensive, and do not come to the attention of the average student. A few brief remarks on "How to Make a Tracing" should therefore prove of interest.

Tracing cloth comes in rolls of various qualities, and at small differences in cost. It is better to purchase rolls which are made up of several pieces of cloth (seconds) of good quality than to buy continuous rolls of a poorer grade.

Either side of the cloth can be used for the drawing, but when, as is very frequently done, the detail is penciled in directly on the cloth, the dull side should be used as the "shiny" or glazed side does not take a pencil mark. Detailng directly on the cloth saves time and the cost of detail paper, and insures accurate work. Use a 3 H pencil. Pencil marks may be easily removed and a tracing cleaned by rubbing with a cloth moistened with naphtha, gasolene or benzine (obtained at any drug store or paint shop). This freshens up the tracing and does not affect waterproof ink. A small piece of tracing cloth from which the preparation has been washed out with water makes a good penwiper and can also be used for the above purpose.

As soon as the cloth is stretched on the drafting board, with dull side up, rub the surface with a small amount of powdered pumice (obtained at drug stores) or the prepared material, called "pounce," which is sold by the dealers in drafting supplies. This removes the excessive gloss and allows the cloth to take the ink more readily. Dust the tracing off so as to thoroughly remove the pounce before applying ink. Instead of pounce many draftsmen prefer to rub the surface with a large soft eraser, for, unless all the powder is removed, it is liable to clog the ruling pen and prevent a free flow of ink.

Instruments come at various prices but a good draftsman needs only a set costing from ten to twenty dollars and containing the following: two ruling pens; one 5½-inch compass, with needle, pen and pencil points and lengthening bar; one 5½-inch hairspring divider; one bow pen; one bow pencil; and a box of leads. For mapping work a contour pen is necessary and a road pen very useful, while for structural steel drafting a rivet pen saves time. Two 12-inch triangular scales—one graduated in fractions of an inch (called an Architect's Scale), and one in decimals (Engineer's Scale)—preferably of the type with graduations on imitation ivory, are indispensable. Also an 8-inch 45 deg., a 4-inch 45 deg., and a 9-inch 60 deg. triangle, preferably transparent, a couple of French curves of the same material, and a 30-inch T-square, with transparent edges.

Ink. Mr. E. C. Easy, C.E., says: "Faint ink never won fair blue print." It is absolutely necessary that the ink used be of the best, and waterproof inks should always be used. These should be kept tightly corked as they evaporate quickly and so become useless for good work. Black ink may be thinned by diluting with distilled water, to which a few drops of ammonia have been added, while the water alone will serve as a dilutant for colored inks. Black, carmine, blue and brown are colors in common use but several other colors may be obtained.

MECHANICAL WORK.

This is done entirely with the instruments and consists of straight and curved lines, either full or broken. The lines should be heavy enough to blue print properly. Many students make the

mistake of using lines which are too fine. Use the medium line of Plate 1. This plate, like the other plates, is a reproduction of actual work on tracing cloth and is the same size as the original. Slight shading, as also shown in Plate 1, often serves to emphasize certain features. Assume the light as coming from the upper left-hand corner at an angle of 45 deg. in a horizontal plane (the plane of the drawing) and shade the lines which would cast shadows.

A fine black line or a medium red line may be used for dimensions. "Dotted" lines are sometimes used, but they take considerable time to make and produce a rather confusing effect where there are many dimensions. The full red line with black arrowheads seems to be the most satisfactory. Do not break dimension lines to insert the figures but place them over the line. This method may not look quite as well as breaking the line for dimensions but saves considerable time. The numbers indicating the dimension are, of course, always in black.

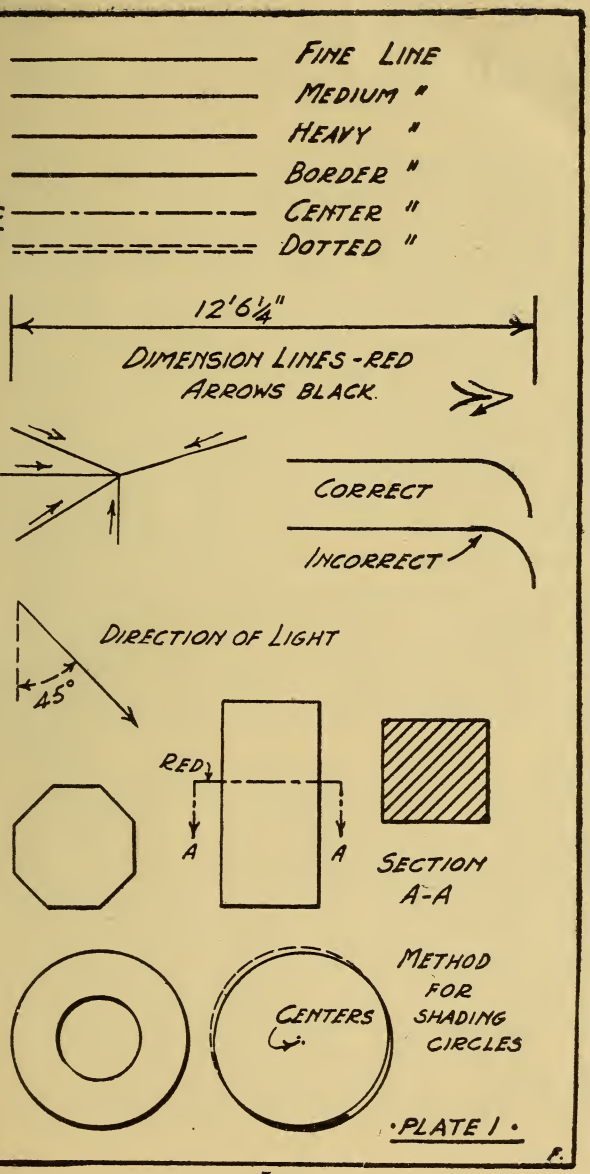
Broken or dotted lines should be made as shown—each dash straight and full, and all of equal length, with small spaces between.

Section lines should be heavy red, dot and dash, indicating the plane at which the section is taken, and the direction in which we are supposed to be looking at it should be shown by black arrowheads.

Where curved and straight lines join, always ink in the curved line first, then the straight one from it.

When several lines meet at a point they should be inked in by ruling toward the point.

Never use a knife to erase on tracing cloth. Use a pencil eraser and plenty of elbow grease. A good rubber turneth away wrath.


FINE LINE
MEDIUM "
HEAVY "
BORDER "
CENTER "
DOTTED "
12'6 1/4"
DIMENSION LINES - RED
ARROWS BLACK.
CORRECT
INCORRECT
DIRECTION OF LIGHT
45°
RED
A
A
SECTION
A-A
CENTERS
METHOD
FOR
SHADING
CIRCLES
·PLATE I·

"Good lettering covers a multitude of sins."
—C. E. See. C.E.

The ability to do good freehand lettering is probably the controlling feature in producing a neat tracing. No matter how well the mechanical work may be done, poor freehand work will spoil the whole effect of the drawing; while, on the other hand, neat lettering will apparently cover many defects in the mechanical work. Freehand lettering can be easily learned by constant practice and use, and, although it is practically the most necessary accomplishment to good drafting and invaluable to a young engineer, yet, either through lack of foresight or pure laziness, not twenty per cent. of the engineering graduates of the present day can do even passable work.

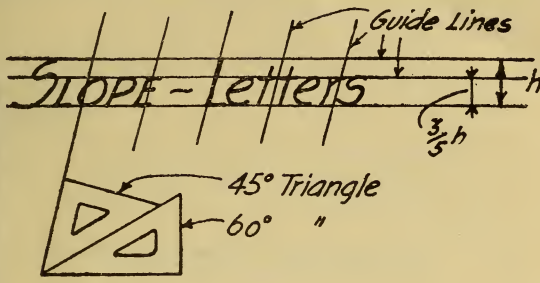
The principal points to remember are: (1) use some standard style and form of lettering and use it consistently; (2) make the small letters three-fifths the height of the large ones; (3) keep the letters on line; and (4) keep them close together.

There are two forms of letters—the vertical and inclined. The inclined is the easier to do well and is for that reason the one to learn. Plate 2 shows how to obtain the correct angle of inclination, which is 75 deg. When starting in to learn freehand lettering, it is best to draw three horizontal and a number of inclined guide lines, but after a little practice it will be found that the only lines necessary are the two horizontal lines which give the height of the small letters.

It is a well known fact that the simpler the letters, the harder they are to do well. It is,

therefore, permissible to introduce what might be termed eccentric forms as long as they are clear and conform in style to the other letters. For example, the letter A if made thus  is very liable to blot at the top,  , while the form  is clear and far easier to make. The tail of the letter R is hard to make if made thus  , while the form  is very simple and pleasing to the eye. The letter S is also rather difficult if made  , while the type  seems to be more easily done. Plate 2 gives a good freehand alphabet consisting of large and small letters, and to be able to make this one style well is all that is necessary. Note also the form for numerals and especially the small numbers and arrows indicating the sequence and direction of the strokes which form the letter or numeral. There is no better way to learn freehand lettering than to spend odd moments in copying Plate 2, making a point of always forming the letters in the manner shown. This method was first devised by Charles W. Reinhardt, and the student is referred to his books, "Mechanical Drafting" and "Lettering for Students, Engineers and Draftsmen," for more complete treatment of the subject.

Freehand lettering is used because it enables us to get more information into a given space with clearness than any other method. The necessity of keeping the letters close together both on this account and because it looks better is therefore self-evident, but is lost sight of by many draftsmen. "Extended lettering," shown at the top of Plate 3, is used for such things as names of countries, cities, avenues, streets, rivers, etc. In this case the above remarks, of course,



ABCDEFGHIJKLMNOPQ

RSTUVWXYZ&

abcdefghijklmnopqrstuvwxyz

¼ 1234567890 ½

·PLATE 2·

F.

HUDSON RIVER

AVENUE "A"

-EXTENDED LETTERING-

ABCDEFGHIJKL

MNOPQRST

UVWXYZ

-SHADED LETTERING-

·ERECTION PLAN·

ROCKY HILL BRIDGE

C., M. & S. R. R.

H. L. Jones

Chief Engineer.

Drawn by C.T. Check'd by R.T.

-TITLE-

·PLATE 3·

do not apply, as it is not necessary to crowd the letters to save space, and the extended form is used in order to cover as much as possible of the object referred to. Many rules have been devised for spacing letters but they can seldom be applied in practice, and the draftsman must depend solely on his eye to determine the proper spacing.

Dimensions, notes, etc., should always be placed parallel to the lower and right-hand borders of the drawing when possible, and always so as to read from left to right or bottom to top. Care should always be taken in placing these notes, etc., to place them in open spaces and avoid confusion and cramping.

The form of letters given in Plate 2 may be used for titles by adding a few lines indicating shading as shown in Plate 3. This makes the title "stand out" and also covers up defects in the letters. In general the title should be included within a rectangle whose sides are from one-quarter to one-third the length of those of the drawing (for ordinary size drawings) and be placed in the lower left-hand corner. The size of the letters is a matter that depends mainly on the judgment of the draftsman, and no fixed rules can be given. A small printing press or a rubber stamp is very useful when a large number of drawings of equal size and similar titles are to be made. This gives the outline of the letters, etc., which can be easily inked in.

For most freehand work a Gillott No. 303 is a good pen and a Gillott No. 404, Ladies' Falcon, and a good ball-pointed pen are also necessary. To produce a uniform line freehand on tracing cloth one must not "bear down" on the pen—just let it rest on the surface of the cloth so that the ink will flow freely.

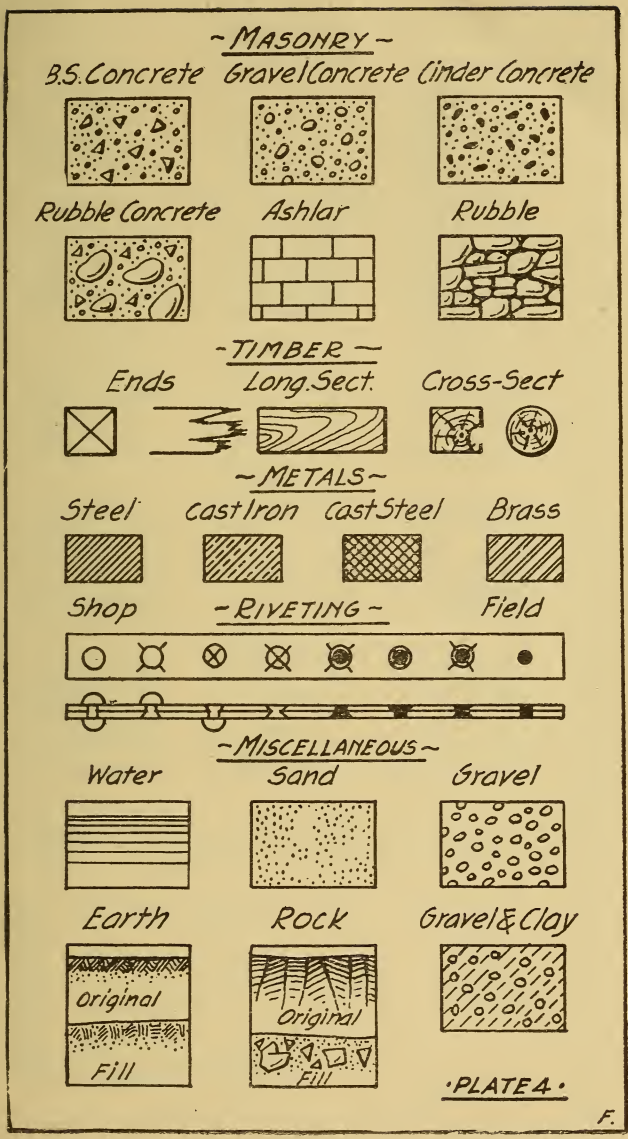
CONVENTIONAL SIGNS.

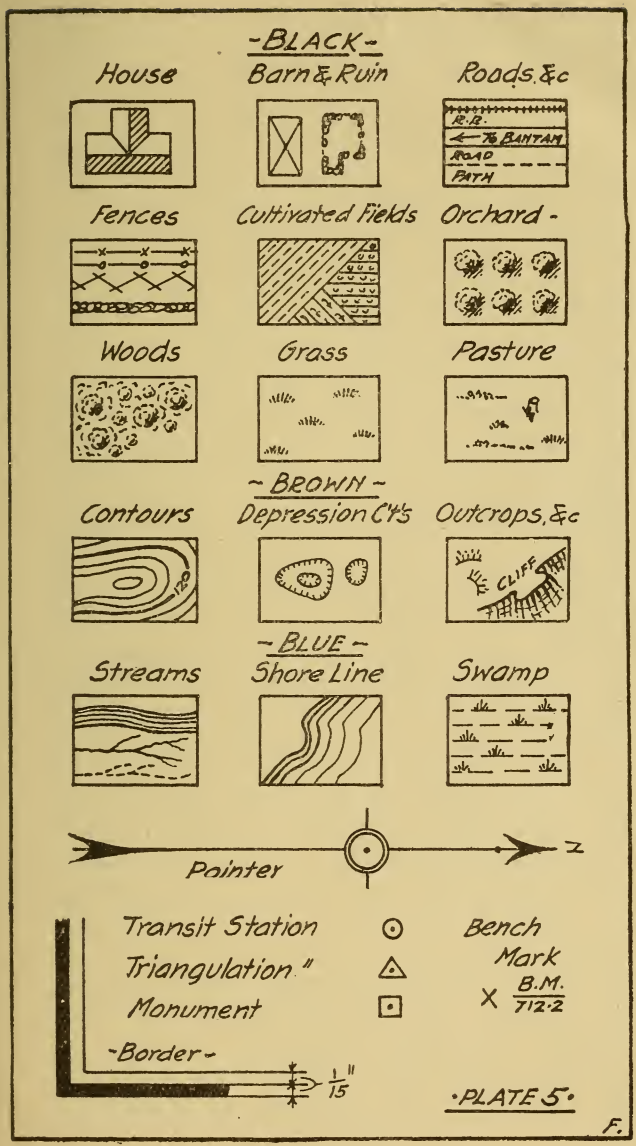
There are a large number of conventional signs in use. Every branch of engineering has special signs to represent the various things peculiar to that particular branch. Plate 4 gives the signs in common use for structural work, which should be familiar to every engineer, and Plate 5 gives some of the various signs used to represent topographical features.

It will be seen from an inspection of these plates that some of the signs involve both mechanical and freehand work. The greater part of them, however, are entirely freehand and require considerable practice to make well. Attention must be given to the thickness of the lines used, and especially to the shading introduced in some of the signs, which is accomplished by an increased thickness of the lines (concrete, rock, cliff, etc.), or by the addition of extra shade lines (rubble concrete, etc.). This shading not only brings out more clearly the character of the thing which is shaded, but adds greatly to the "style" of the drawing. For finished drafting the development of a style is just as important as it is in any other art. About all that can be said in regard to making these various signs is that practice makes perfect.

BLUE PRINTS.

Little need be said on this subject, as most of the prints are made these days by companies which make this their business. Every large drafting supply company has a blue print department where prints are made by arc light, in special


~MASONRY~
B.S. Concrete
Gravel Concrete
Cinder Concrete
Rubble Concrete
Ashlar
Rubble
~TIMBER~
Ends
Long. Sect.
Cross-Sect
~METALS~
Steel
Cast Iron
Cast Steel
Brass
Shop
~RIVETING~
Field
~MISCELLANEOUS~
Water
Sand
Gravel
Earth
Rock
Gravel & Clay
Original
Fill
Original
Fill
·PLATE 4·
F.


-BLACK-
House
Barn & Ruin
Roads, &c
R.R.
To BANTAM
ROAD
PATH
Fences
Cultivated Fields
Orchard -
Woods
Grass
Pasture
- BROWN -
Contours
Depression C'ts
Outcrops, &c
CLIFF
- BLUE -
Streams
Shore Line
Swamp
Pointer
N
Transit Station
Triangulation "
Monument
Bench Mark
B.M. 712·2
-Border-
1/15"
·PLATE 5·
F.

machines, and at a smaller cost than it would be possible to do this work under the old system of sun printing in the engineer's office. The paper used is of two kinds known as "fast" and "slow" printing paper. The fast paper, in common use, requires about 40 seconds of bright sunlight. Care in handling and storing the paper before use and thorough washing in tepid water after printing are essential to good work.

Prints are made from a tracing in the same manner as they are obtained from a plate or film in photographic work. The tracing, however, is a positive (while the film is a negative) and the prints obtained are therefore negative, having white lines on a blue field. Corrections or additions may be made on a blue print by using, instead of ink, a solution of common washing or baking soda dissolved in water. This fades out the blue background and leaves a white mark. If a colored line is desired it may be obtained by mixing the colored ink with the soda solution in proportions determined by trial. When the tracing is a drawing showing preliminary work, or a map on which work is to be planned out, it is desirable to have a positive print, with the lines only colored, the back-ground being white. This may be done either by the black print process, which consists in making a plate from which prints are made in a special printing press, or a negative may be made from the tracing and positive prints obtained from this negative. The former process produces very good results but requires special, patented machinery. The latter method is accomplished by first making a print on a special, thin paper which gives white lines on a deep brown field. This print is then made transparent by using one of the special liquids

made for this purpose and sold by the dealers, or by running it through a solution of paraffine dissolved in benzine. Use a solution of about one heaped tablespoon full of flaked paraffine to a glass of benzine. The benzine evaporates, leaving the paraffine. Several immersions may be necessary to produce the desired result, but it distributes the paraffine more evenly than when a saturated solution is used. The same result may be obtained by using paraffine oil, castor oil, etc., but they dissolve printer's ink and so cannot be used to make printed drawings transparent, while the above method enables us to get very good prints from plates taken from the various engineering papers, journals, etc.

Quite recently A. R. Dodge, 136 Liberty St., New York., has gotten out a method of cementing a drawing or blue print between two layers of a water, oil and dirtproof material resembling celluloid. This is not very expensive, and is extremely useful in preserving prints which are handled a great deal. Prints may also be mounted on cardboard, and then coated with white shellac.

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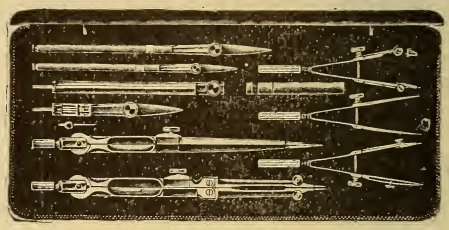

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